

Honors credit

Those registered for honors credit must complete one of the the following assignments in order to receive the credit. Either 1) write a paper on a topic of current physics research which involves quantum mechanics or 2) solve a quantum mechanics problem on a topic not covered in class.

If you choose **1)** your paper should explore one or more of the following questions:

How is Q.M. used in this area of research?

Which methods and ideas from Q.M. are important in this research?

What does this area of research teach us about Q.M.?

What is exciting or interesting about this research?

What are the potential applications of this research?

Does this area of research involve both theory and experiment, and are they in agreement?

Possible topics include:

quantum computing, quantum cryptography, quantum teleportation

neutrino oscillations

astrophysical masers

Search for the Higgs boson

Bose-Einstein condensation

high T_c superconductivity

quantum dots in semiconductors

Change of the fine structure constant with time

dark matter or dark energy

If you choose a topic not on this list it is necessary for you to discuss your proposed topic with me in advance.

If you choose **2)** you must see me to discuss your proposed quantum mechanics problem. Some sample topics are listed below but you are free to choose something else. I will be happy to help guide you towards solving your chosen problem.

a) Quantize the electromagnetic field and verify that the field is equivalent to a collection of harmonic oscillators.

b) Calculate (numerically) the first few energy levels and eigenfunctions of a two-dimensional quartic oscillator. (this is relevant to some laser traps for atoms we are developing).

c) Develop an analytical formula for atomic dipole matrix elements using a semiclassical description and compare with the quantum mechanical results.

Schedule:

Due: last day of class, December, 14.

Length: minimum of 4 pages, typewritten